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Crane or excavator with optimal movement control for the transaction of a load, which is carried by a load cable.

Patent Claims

1. Crane or excavator for the transaction of a load, which is carried by a load cable with a turning mechanism for the rotation of the crane or excavator, a seesaw mechanism for the erection or incline of an extension arm and a hoisting gear for the lifting or lowering of the load which is carried by a cable with an actuation system,

characterized by

a track control system (31), whose starting points (u_{outD} , u_{outA} , u_{outL} , u_{outR}) go directly or indirectly into the control system as input values for position or speed of the crane (41) or excavator, whereas the set points for the control system (31) in the track control are generated in such a way, that a load movement results from it with minimized oscillation amplitudes.

2. Crane or excavator in accordance with claim 1, characterized by the fact that the model based optimal control trajectory inside the track control system (31) can be calculated and updated in real time.
3. Crane or excavator in accordance with claim 2, characterized by a model based optimal control trajectory based on a model which is linearized by reference trajectories.
4. Crane or excavator in accordance with claim 2, characterized by a model based optimal control trajectory based on a non-linear model approach.
5. Crane or excavator in accordance with one of the claims 1 to 4, characterized by a model based optimal control trajectory with feedback of all status values.
6. Crane or excavator in accordance with one of the claims 1 to 4, characterized by a model based optimal control trajectory with feedback of at least one measured variable and estimation of the remaining status values.
7. Crane or excavator in accordance with one of the claims 1 to 4, characterized by a model based optimal control trajectory with feedback of at least one measured variable and set point tracking of the remaining status values by model based feed forward control.
8. Crane or excavator in accordance with one of the claims 1 to 7, characterized by the fact that the track control system (31) can be implemented as fully automatic or as semi-automatic.

9. Crane or excavator in accordance with one previous claims, characterized by the fact that a set point matrix (35) for position and orientation of the load can be entered as an input value into the track control system (31).
10. Crane or excavator in accordance with one previous claims, characterized by the fact that the set point matrix (35) consists of start and arrival point.
11. Crane or excavator in accordance with one previous claims, characterized by the fact that the desired arrival speed of the load can be entered into the track control system (31) by the position of the hand lever (34) in case of a semi-automatic operation.
12. Crane or excavator in accordance with claim 11, characterized by the fact that the measuring values of the positions of crane and load can be measured via sensors and entered into the track control system (31) in case of a semi-automatic operation.
13. Crane or excavator in accordance with claim 11, characterized by the fact that the positions of crane and load can be estimated in a module for model based estimation processes (43) and can be entered into the track control system (31).
14. Crane or excavator in accordance with one of the previous claims, characterized by the fact that the output values (u_{outD} , u_{outA} , u_{outL} , u_{outR}) are entered first into an underlying control system with load oscillation damping.
15. Crane or excavator in accordance with claim 14, characterized by the fact that the load oscillation damping system has at least one track planning module, one centripetal force compensation device, one axis controller for the turning mechanism, one axis controller for the seesaw mechanism, one axis controller for the hoisting gear and one axis controller for the turning mechanism.

16. Crane or excavator in accordance with one previous claims, characterized by the fact that the movement of the load can be specified in such a way by the track control system (31), that pre-determined free areas cannot be left by the oscillating load.